Teaching and Learning

Understanding Learning in the Nanoscience Context: Basic Research and Evaluation

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Session Goals

- What have we learned so far?
- What do you want to learn about your courses and student learning?
- How can we work in partnership on evaluation and research?

What have we learned about courses?

Course Context

- Material Science for Non-majors
- 3 lecture unit on nanotechnology taught by an expert in nanotechnology
- 78 students

Evaluation Questions

- Do students make test gains?
- What concepts are most challenging?
- Does interest in nanotechnology increase?
- Do students find the material valuable?
- How difficult is the nanotechnology unit?

Instruments & Procedure

Nanoconcept Inventory – Mark Hersam

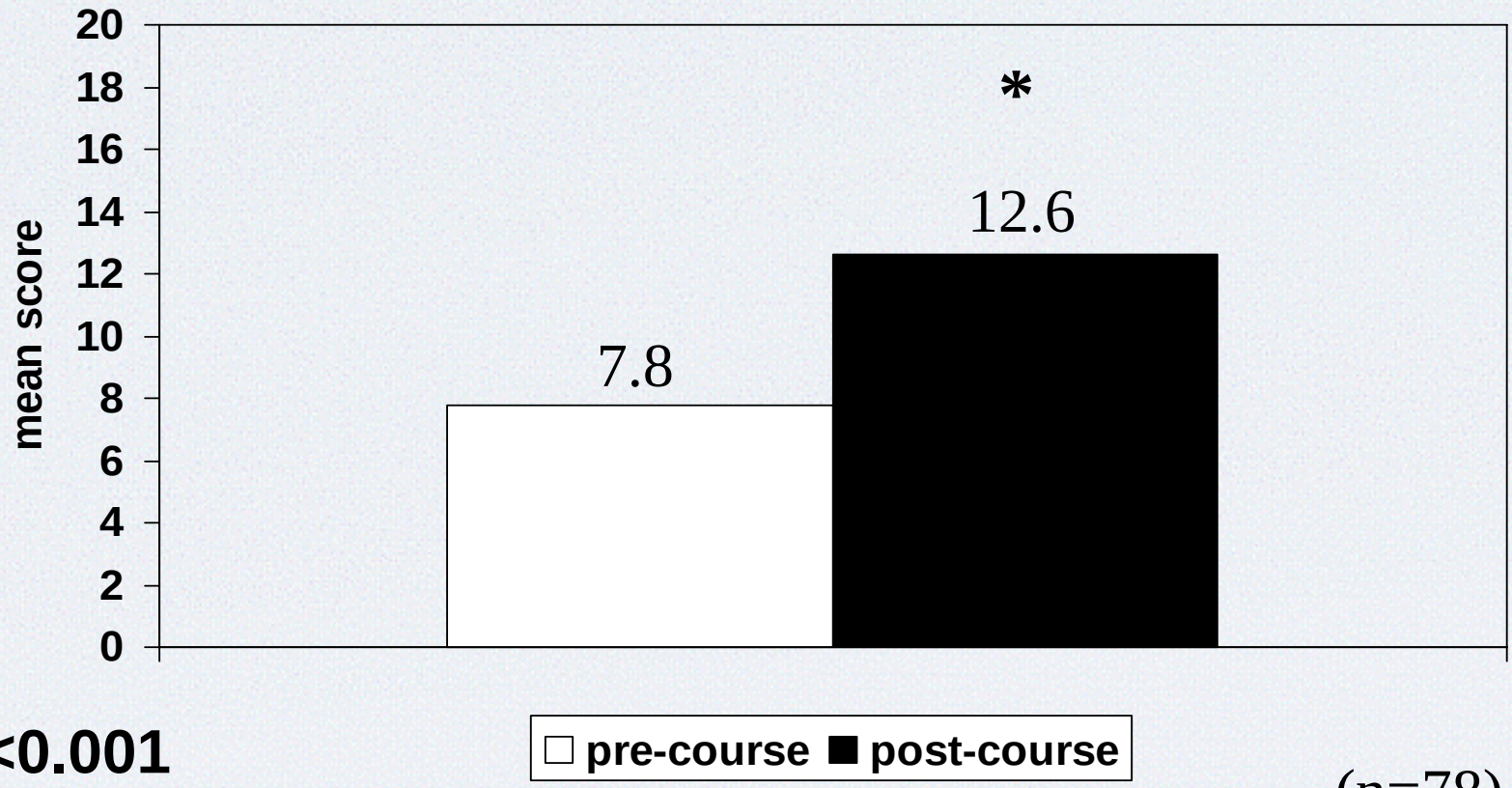
Students' Evaluation of Education Quality (SEEQ) (Marsh, 1982)

http://129.105.164.200/surveys/htmlfolder/nanotechnology_survey_2.htm

Administered pre and post course

Comparison of mean pre and post scores on the Nanoscience Concept Inventory

(Material Science for Non-majors, 2005)



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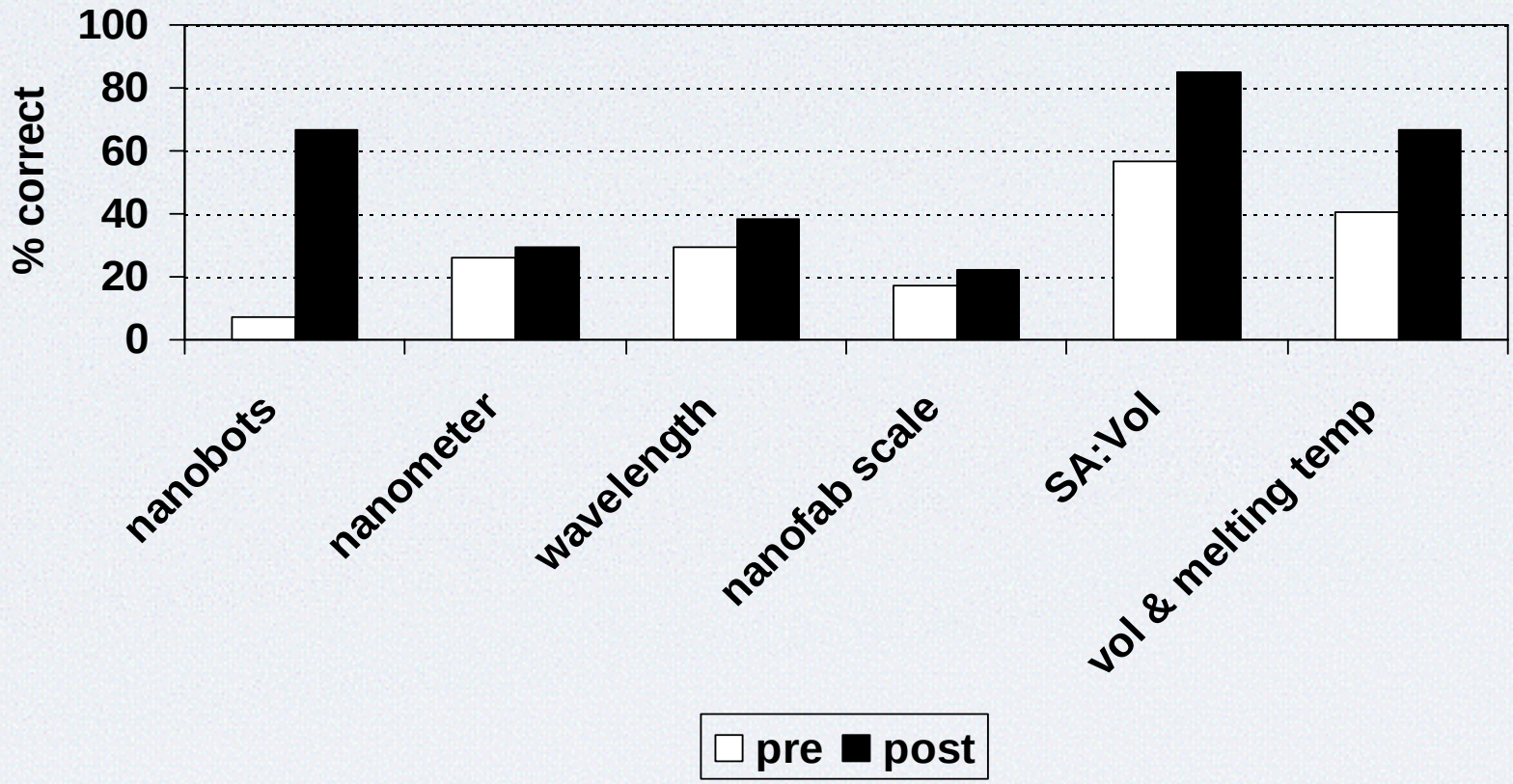
(n=78)

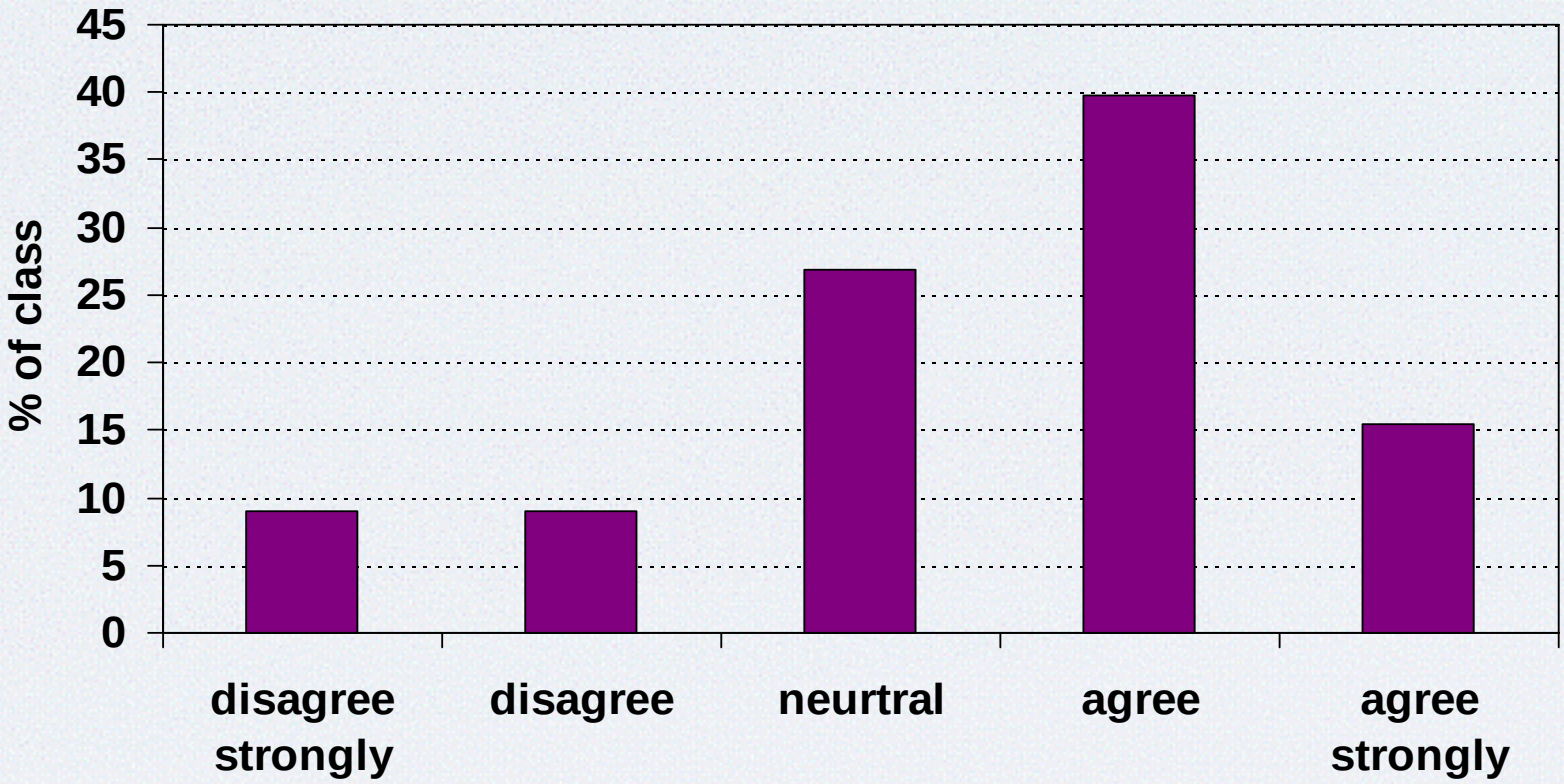
Comparison of pre and post scores on the Nanotechnology Concept Inventory

(Material Science for Non-majors, 2005)



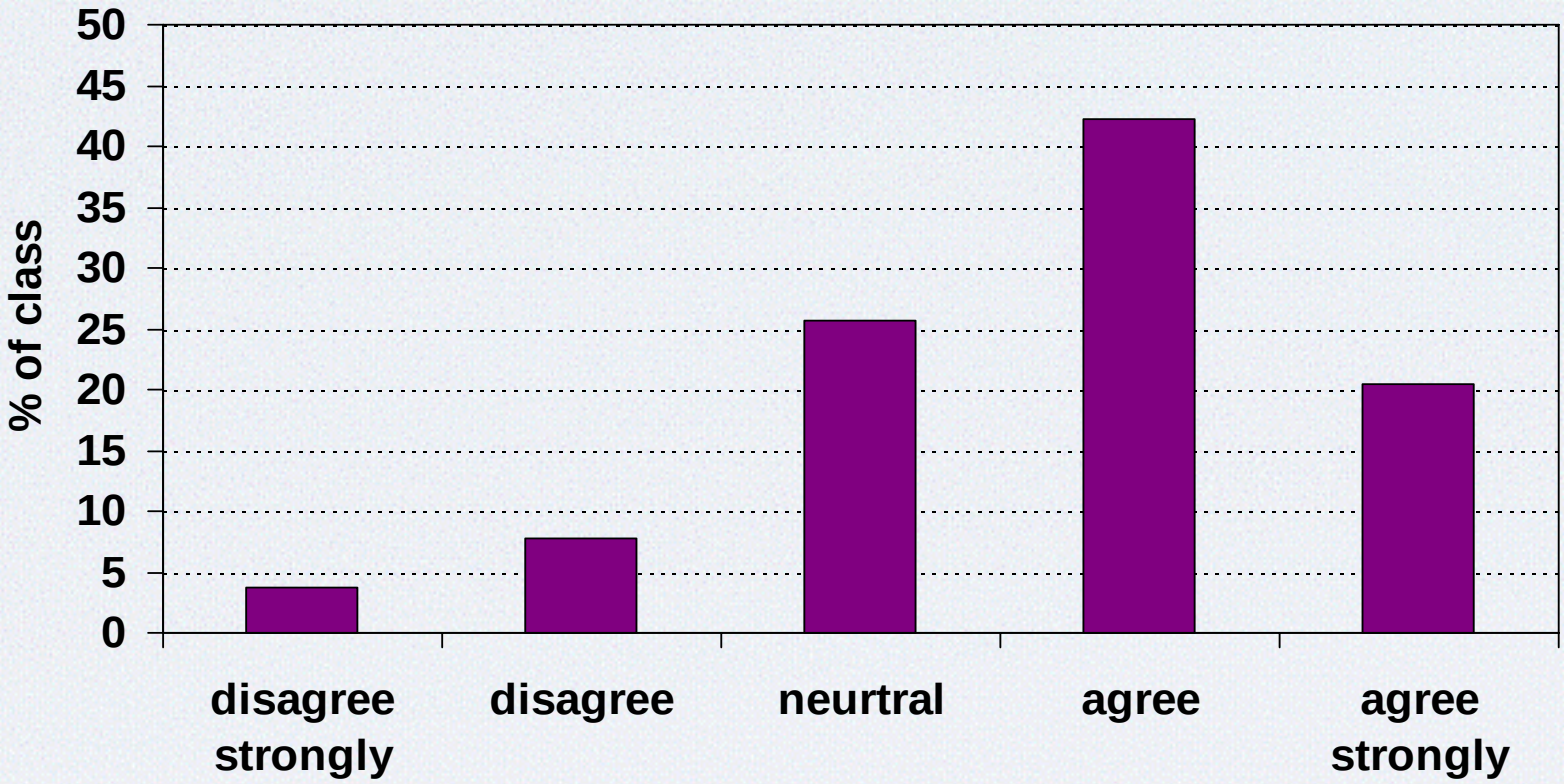
Interest in nanotechnology has increased as a consequence of the class

(Material Science for Non-majors, 2005)



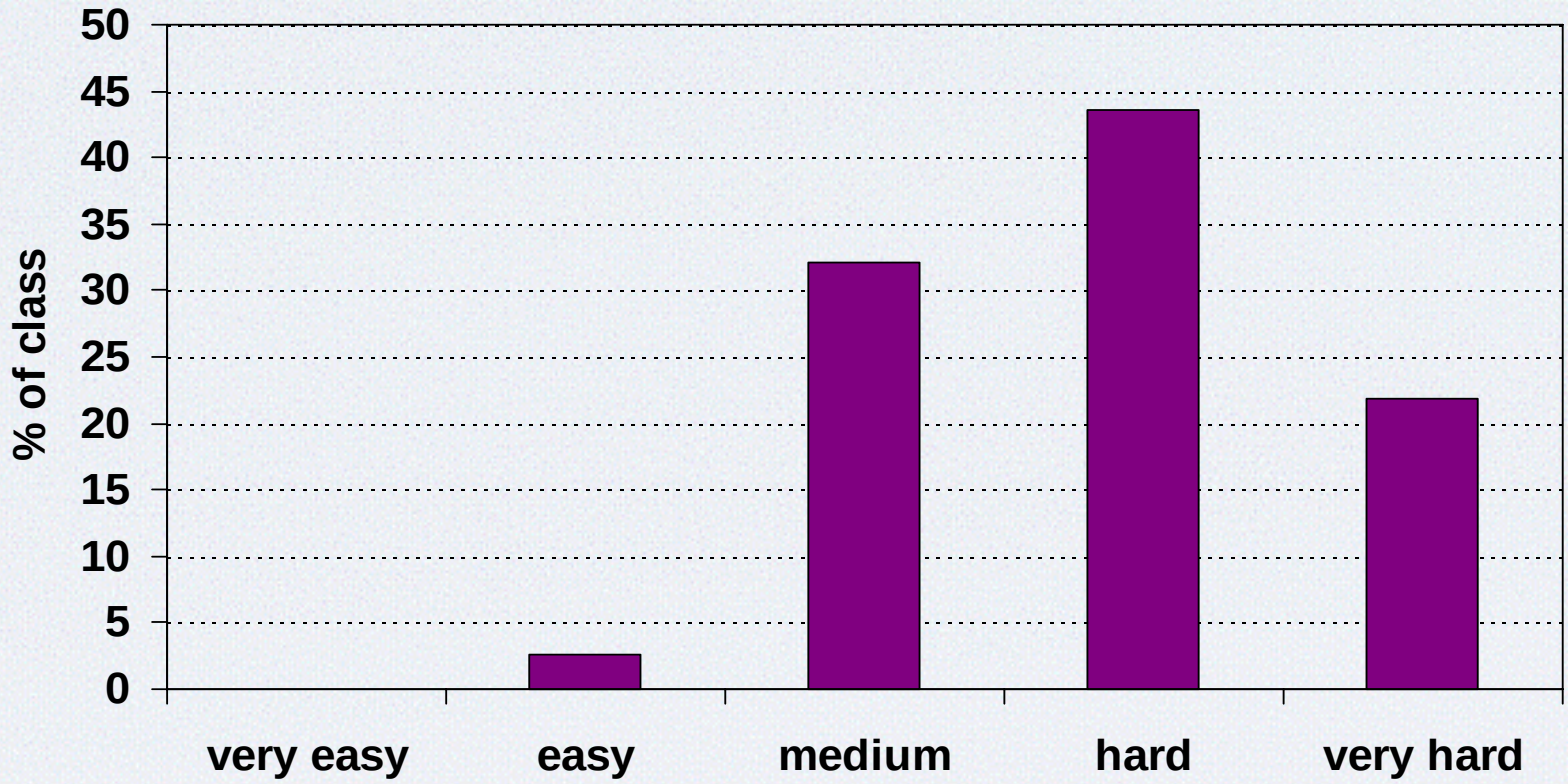
Learned something that you consider valuable

(Material Science for Non-majors, 2005)



Topic difficulty relative to other topics in the course

(Material Science for Non-majors, 2005)



What have we learned about student learning?

Research Context

- 28 freshmen in an engineering design class
- 61 Material Science for Non-majors

Research Questions

- How do students understand size and scale?
- How do students understand dominant forces?
- What misconceptions do they hold?
- Do we see variation in conceptions among low-medium-high achievers?

Instruments and Procedures

- 27 item concept inventory
  - Size & scale, surface area to volume
- Administered at the beginning of the course
- Interviewed 3 High, 3 medium and 3 low achievers - think aloud

Items for Size and Scale

- football field
- elephant
- science textbook
- human hair
- virus
- bacterium
- hydrogen atom

Dominant Forces

- gravity
- electrostatic
- adhesion
- van der Waals
- strong nuclear

Preliminary Findings - Size

- More comfortable with the visible world.
- Better with ranking size than relative size.
- Items not visible to the naked eye are very close in size.
- Many lack reference points.

Preliminary Findings - Scale

- Metric units are confusing for some.
- Some struggle with powers of 10.
- Many do not fully understand the logarithmic scale.

Preliminary Findings – Dominant Forces

- Dominant forces are extremely difficult.
  - Many students do not understand the underlying mechanisms.
- Can't make judgments about the effect of forces as size changes.
- Adhesion only applies to water.